Foundations of Algebra Unit 6: Systems of Equations & Inequalities Notes

Problem Solving with Linear Inequalities

Example 1: Noah plays football. His team's goal is to score at least 24 points per game. A touchdown is worth 6 points and a field goal is worth 3 points. Noah's league does not allow the teams to try for the extra point after a touchdown. The inequality $6x + 3y \geq 24$ represents the possible ways Noah's team could score points to reach their goal.

x = TD, y = F.G.

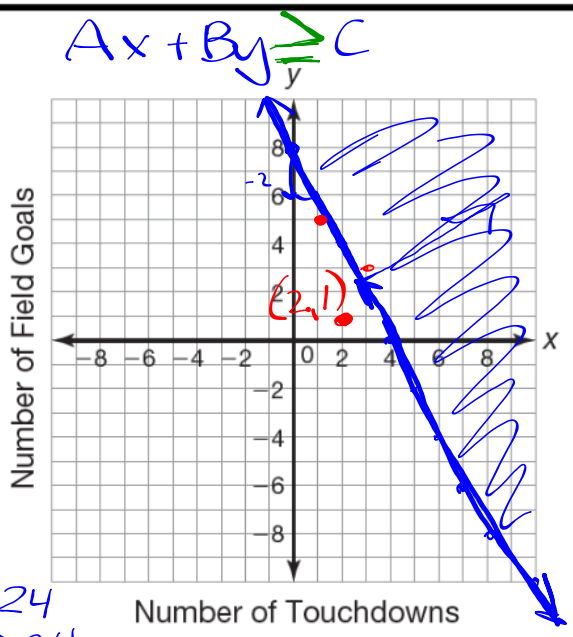
a. Graph the inequality on the graph.

$6x+3y \geq 24$

$-6x \quad -6x$

$3y \geq -6x+24$

$y \geq -2x+8$



b. Are the following combinations solutions to the problem situation? Use your graph AND algebra to answer the following:

1. 2 touchdowns and 1 field goal

NO (2, 1)

x y

$6x+3y \geq 24$

$6(2)+3(1) \geq 24$

$12+3 \geq 24$

$15 \geq 24$

2. 1 touchdown and 5 field goals

(1, 5)

3. 3 touchdowns and 3 field goals

(3, 3)

Creating Systems of Inequalities

Write a system of inequalities to describe each scenario.

a. Jamal runs the bouncy house a festival. The bouncy house can hold a maximum of 1200 pounds at one time. He estimates that adults weight approximately 200 pounds and children under 16 weight approximately 100 pounds. For 1 four minute session of bounce time, Jamal charges adults $3 each and children $2 each. Jamal hopes to make at least $18 for each session.

- Define your variables:
  - x: # of adults
  - y: # of children
- Write a system of inequalities
  - Inequality 1: $200x+100y \leq 1200$ describes pounds
  - Inequality 2: $3x+2y \geq 18$ describes cost ($)
- If 4 adults and 5 children are in 1 session, will that be a solution to the inequalities?

$200(4)+100(5) \leq 1200$

$800+500 \leq 1200$

$1300 \leq 1200$

NO

$200x + 100y \leq 1200$ $3x + 2y \geq 18$

- If 2 adults and 7 children are in 1 session, will that be a solution to the inequalities?

(2, 7) $200(2) + 100(7) \leq 1200$ $3(2) + 2(7) \geq 18$

$400 + 700 \leq 1200$ $6 + 14 \geq 18$

yes $1100 \leq 1200$ yes $20 \geq 18$ ✓

b. Charles works at a movie theater selling tickets. The theater has 300 seats and charges $7.50 for adults and $5.50 for children. The theater expects to make at least $1500 for each showing.

- Define your variables:

x = # of adults

y = # of children

- Write a system of inequalities

Inequality 1: $x + y \leq 300$ describes total seats

Inequality 2: $7.5x + 5.5y \geq 1500$ describes cost tix

$x + y \leq 300$

- If 150 adults and 180 children attend, will that be a solution to the inequalities?

(150, 180) $150 + 180 \leq 300$

x, y $330 \leq 300$ NO!

- If 175 adults and 105 children attend, will that be a solution to the inequalities?

Day 12 – Understanding Solutions

A **solution** is any number or ordered pair that makes an equation, inequality, or system true. We determine whether numbers or ordered pairs are solutions by:

- Substituting into the equation/inequality/system to see if it produces a true statement
- Looking at a graph and determining if the ordered pair is on the line (linear equation or system of equations) or falls in the shaded boundary area (linear inequality or system of inequalities)

Word of Caution: If a point falls on a dotted line, it is NOT part of the solution set!!

Determining Solutions from a Graph

Linear Function	Linear Inequality

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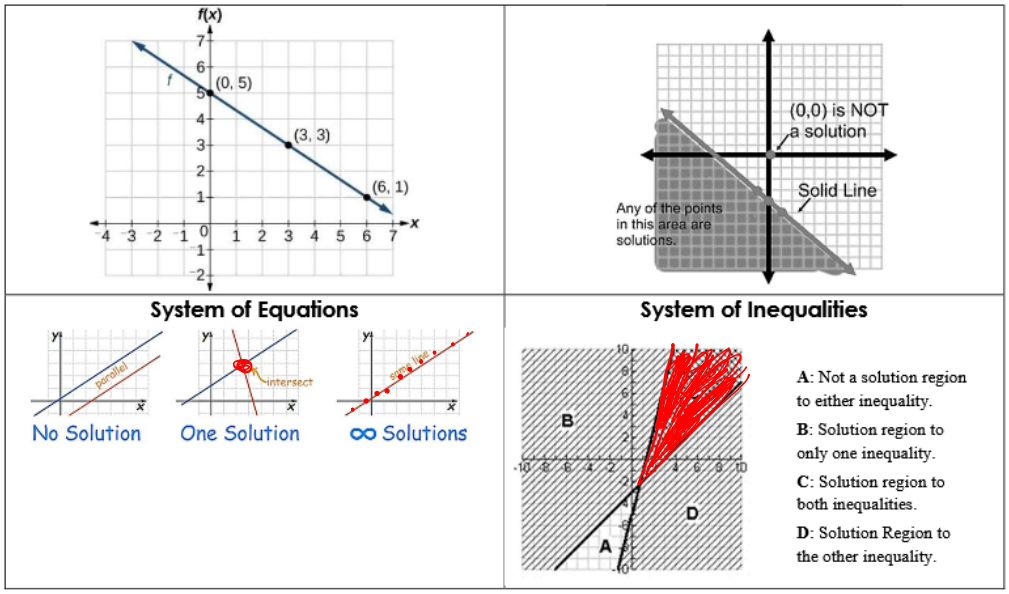
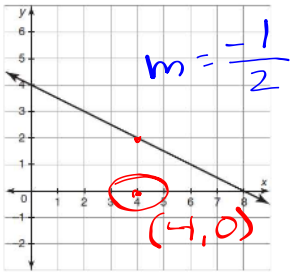


Practice: Analyze the following graphs. Determine if the following points are solutions or not. Explain your reasoning.

a.



$y = -\frac{1}{2}x + 4$

a. Is (4, 2) a solution to the linear function?

$2 = -\frac{1}{2}(4) + 4$

$2 = -2 + 4$

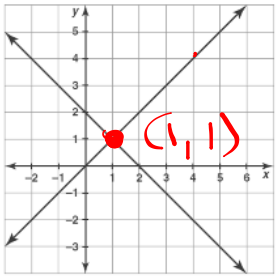
$\frac{2}{2} = \frac{2}{2}$

yes!

b. Is (4, 0) a solution to the linear function?

NO!

b.



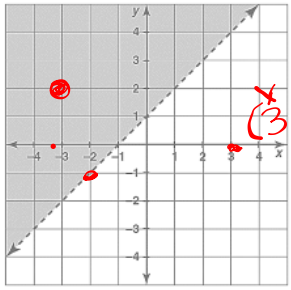
a. Is (4, 4) a solution to the system?

NO!

b. Is (1, 1) a solution to the system?

yes!

c.



a. Is (3, 0) a solution to the linear inequality?

no!

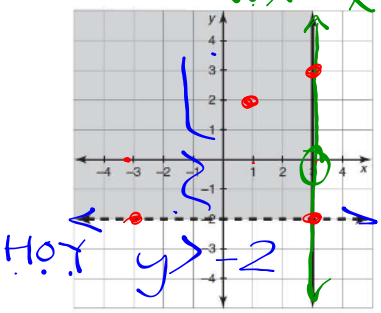
b. Is (-2, -1) a solution to the linear inequality?

no (it's on dashed line)

c. Is (-3, 2) a solution to the linear inequality?

yes - in shaded area

d.



a. Is (1, 2) a solution to the system of inequalities?

yes

b. Is (-3, -2) a solution to the system of inequalities?

no - on dashed line

c. Is (3, 3) a solution to the system of inequalities?

yes - on solid line

d. Is (3, -2) a solution to the system of inequalities?

no - on dashed line

Determining Solutions from Equations

Linear Functions/Systems	Linear/System Inequalities
Substitute your coordinate point in for all equations. If the resulting equation is **TRUE** for **ALL** equations, the coordinate point is a **SOLUTION.** If the resulting equation is **FALSE** for **ANY** of the equations, the coordinate point is **NOT A SOLUTION.**	Substitute your coordinate point in for all inequalities. If the resulting inequality is **TRUE** for **ALL** inequaities, the coordinate point is a **SOLUTION.** If the resulting inequallity is **FALSE** for **ANY** of the inequalities, the coordinate point is **NOT A SOLUTION.**

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